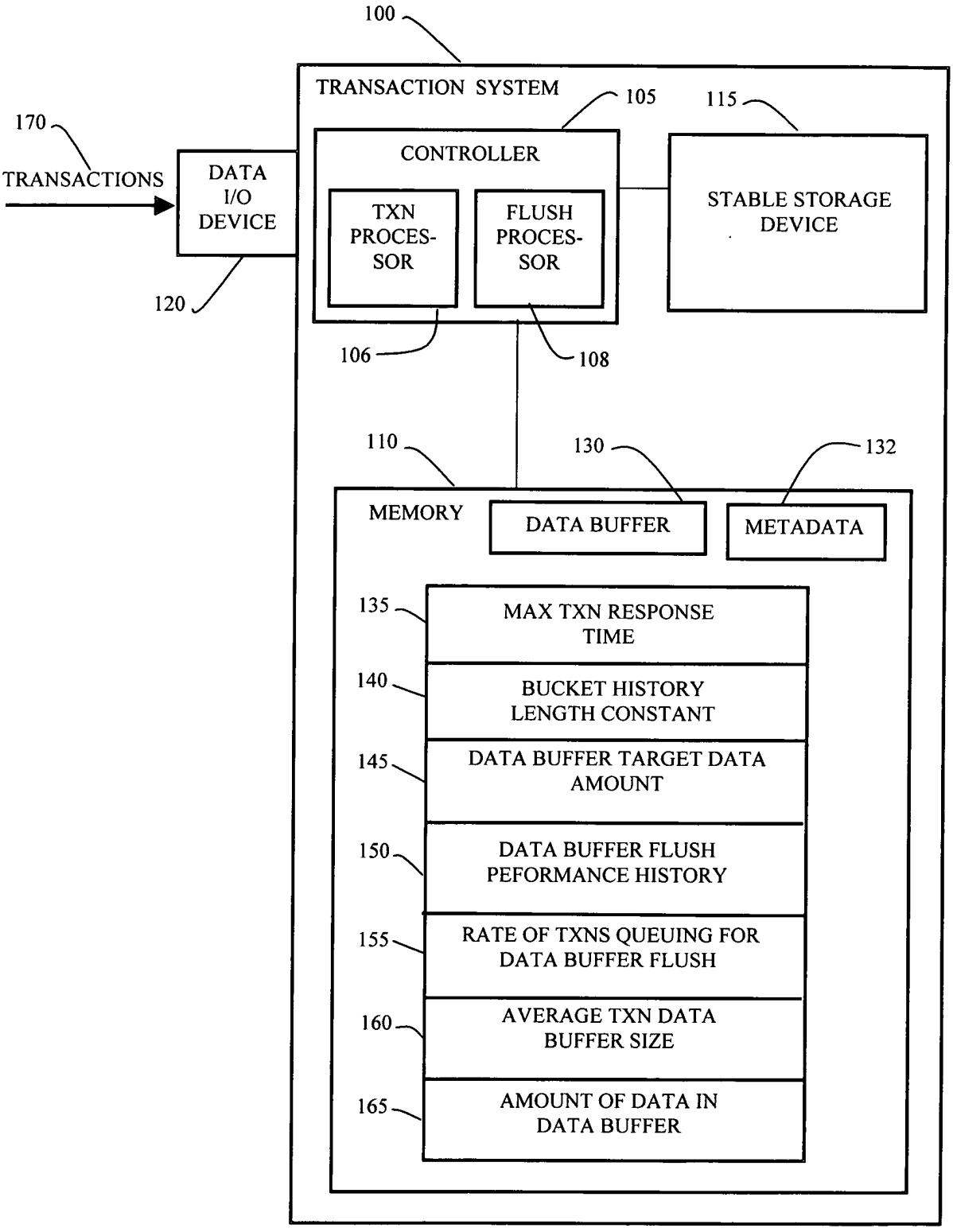

100
TRANSACTION SYSTEM
105
115
170
TRANSACTIONS
DATA I/O DEVICE
CONTROLLER
TXN PROCES-SOR
FLUSH PROCES-SOR
STABLE STORAGE DEVICE
120
106
108
110
130
132
MEMORY
DATA BUFFER
METADATA
135
MAX TXN RESPONSE TIME
140
BUCKET HISTORY LENGTH CONSTANT
145
DATA BUFFER TARGET DATA AMOUNT
150
DATA BUFFER FLUSH PEFORMANCE HISTORY
155
RATE OF TXNS QUEUING FOR DATA BUFFER FLUSH
160
AVERAGE TXN DATA BUFFER SIZE
165
AMOUNT OF DATA IN DATA BUFFER

FIGURE 1

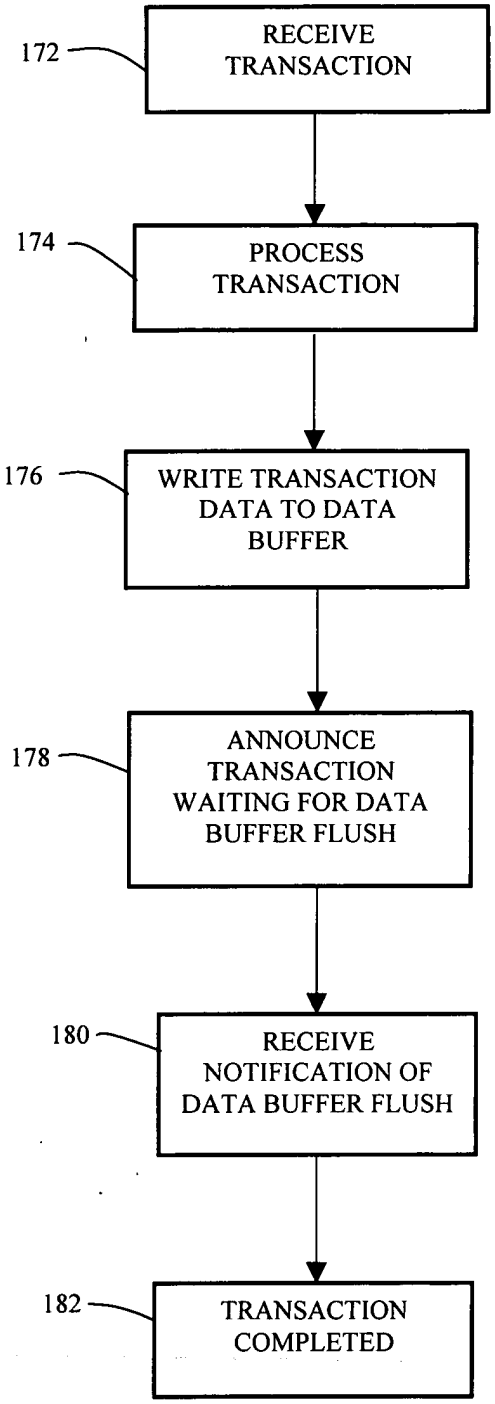

172
RECEIVE TRANSACTION
174
PROCESS TRANSACTION
176
WRITE TRANSACTION DATA TO DATA BUFFER
178
ANNOUNCE TRANSACTION WAITING FOR DATA BUFFER FLUSH
180
RECEIVE NOTIFICATION OF DATA BUFFER FLUSH
182
TRANSACTION COMPLETED

FIGURE 2

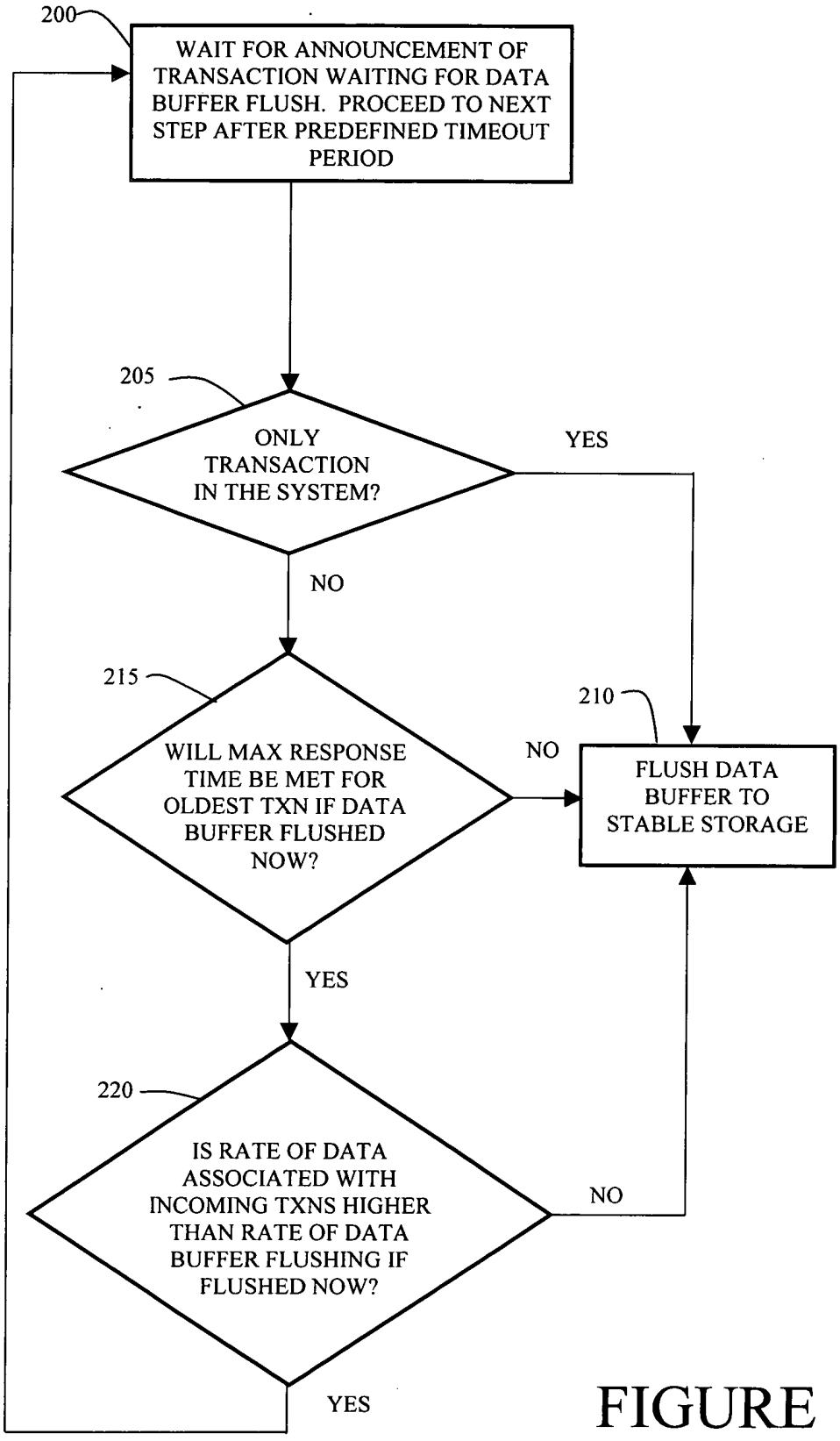

200
WAIT FOR ANNOUNCEMENT OF TRANSACTION WAITING FOR DATA BUFFER FLUSH. PROCEED TO NEXT STEP AFTER PREDEFINED TIMEOUT PERIOD
205
ONLY TRANSACTION IN THE SYSTEM?
YES
NO
215
WILL MAX RESPONSE TIME BE MET FOR OLDEST TXN IF DATA BUFFER FLUSHED NOW?
NO
210
FLUSH DATA BUFFER TO STABLE STORAGE
YES
220
IS RATE OF DATA ASSOCIATED WITH INCOMING TXNS HIGHER THAN RATE OF DATA BUFFER FLUSHING IF FLUSHED NOW?
NO
YES

FIGURE 3

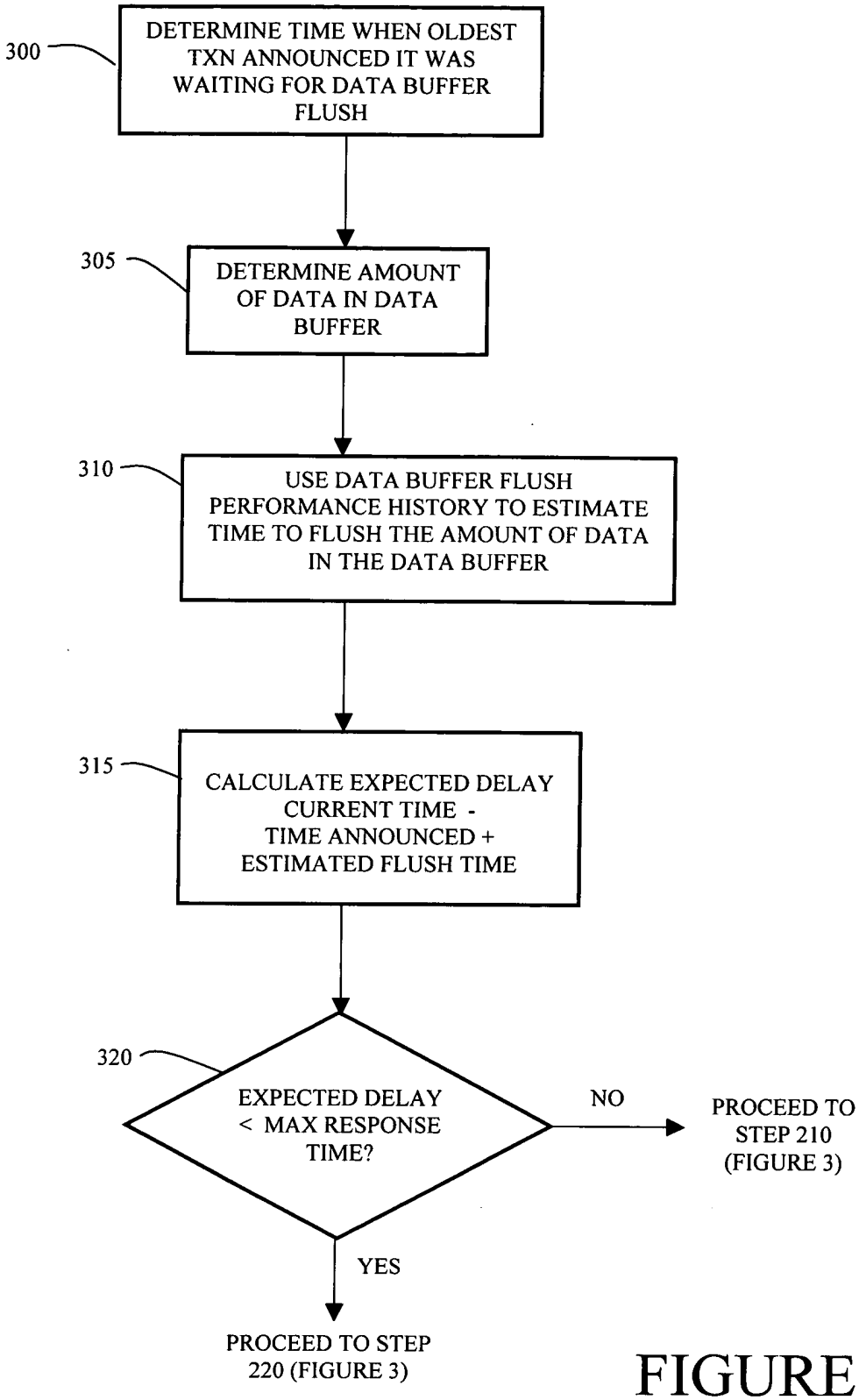
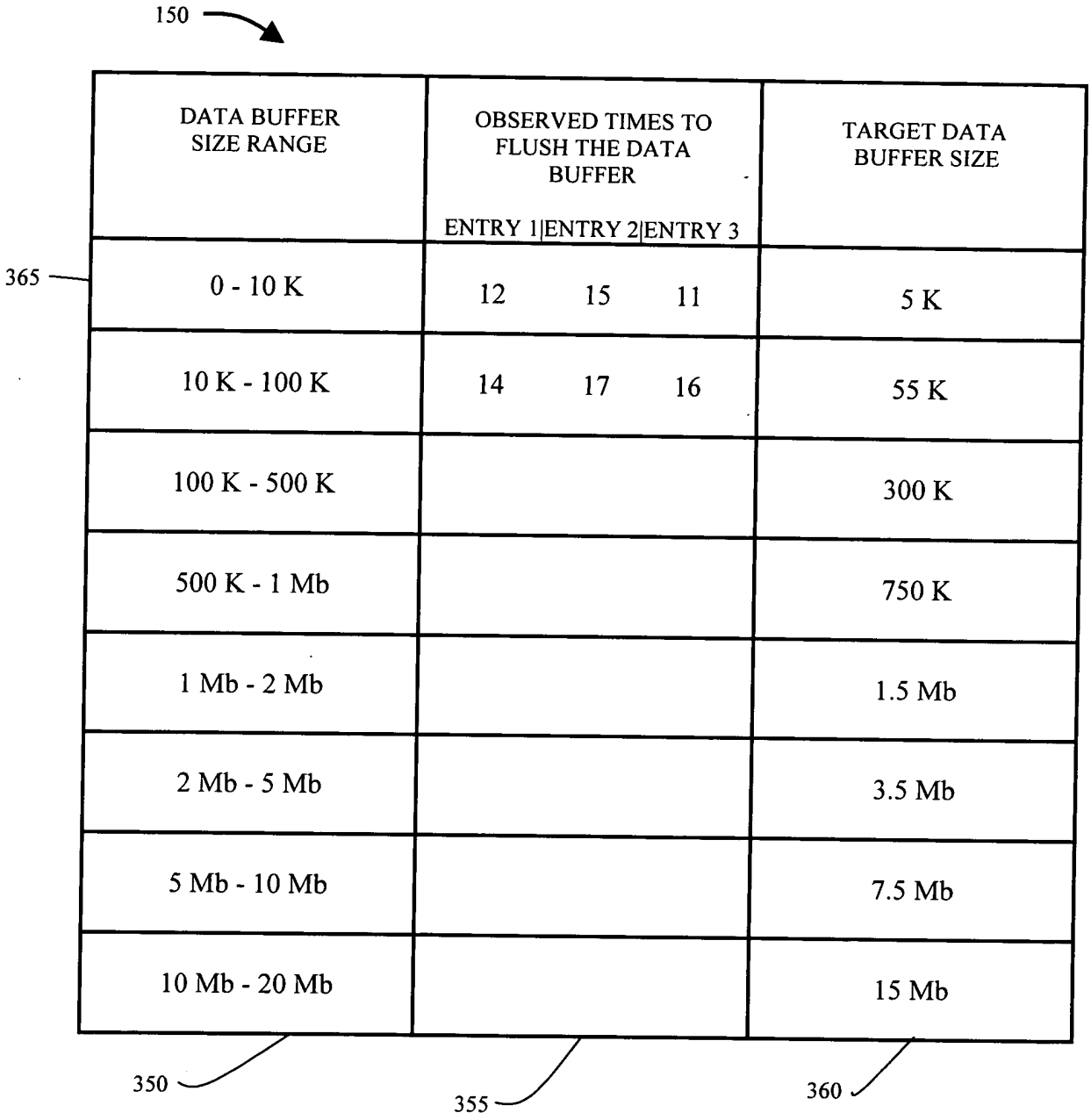

300
DETERMINE TIME WHEN OLDEST TXN ANNOUNCED IT WAS WAITING FOR DATA BUFFER FLUSH
305
DETERMINE AMOUNT OF DATA IN DATA BUFFER
310
USE DATA BUFFER FLUSH PERFORMANCE HISTORY TO ESTIMATE TIME TO FLUSH THE AMOUNT OF DATA IN THE DATA BUFFER
315
CALCULATE EXPECTED DELAY
CURRENT TIME -
TIME ANNOUNCED +
ESTIMATED FLUSH TIME
320
EXPECTED DELAY < MAX RESPONSE TIME?
NO
PROCEED TO STEP 210 (FIGURE 3)
YES
PROCEED TO STEP 220 (FIGURE 3)

FIGURE 4



DATA BUFFER SIZE RANGE	OBSERVED TIMES TO FLUSH THE DATA BUFFER ENTRY 1 | ENTRY 2 | ENTRY 3	TARGET DATA BUFFER SIZE
0 - 10 K	12 15 11	5 K
10 K - 100 K	14 17 16	55 K
100 K - 500 K		300 K
500 K - 1 Mb		750 K
1 Mb - 2 Mb		1.5 Mb
2 Mb - 5 Mb		3.5 Mb
5 Mb - 10 Mb		7.5 Mb
10 Mb - 20 Mb		15 Mb

FIGURE 5

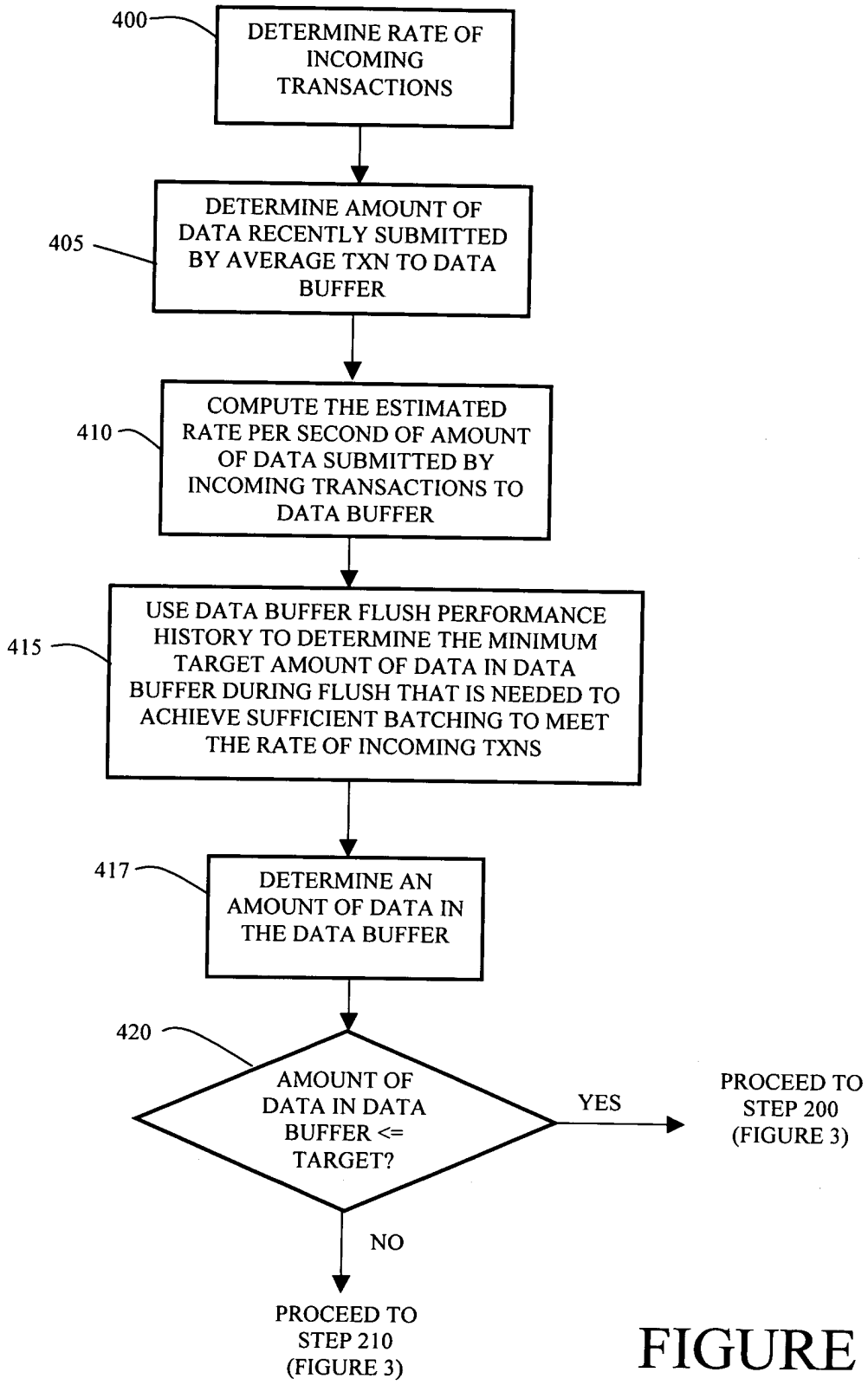

400
DETERMINE RATE OF INCOMING TRANSACTIONS
405
DETERMINE AMOUNT OF DATA RECENTLY SUBMITTED BY AVERAGE TXN TO DATA BUFFER
410
COMPUTE THE ESTIMATED RATE PER SECOND OF AMOUNT OF DATA SUBMITTED BY INCOMING TRANSACTIONS TO DATA BUFFER
415
USE DATA BUFFER FLUSH PERFORMANCE HISTORY TO DETERMINE THE MINIMUM TARGET AMOUNT OF DATA IN DATA BUFFER DURING FLUSH THAT IS NEEDED TO ACHIEVE SUFFICIENT BATCHING TO MEET THE RATE OF INCOMING TXNS
417
DETERMINE AN AMOUNT OF DATA IN THE DATA BUFFER
420
AMOUNT OF DATA IN DATA BUFFER <= TARGET?
YES
PROCEED TO STEP 200 (FIGURE 3)
NO
PROCEED TO STEP 210 (FIGURE 3)

FIGURE 6

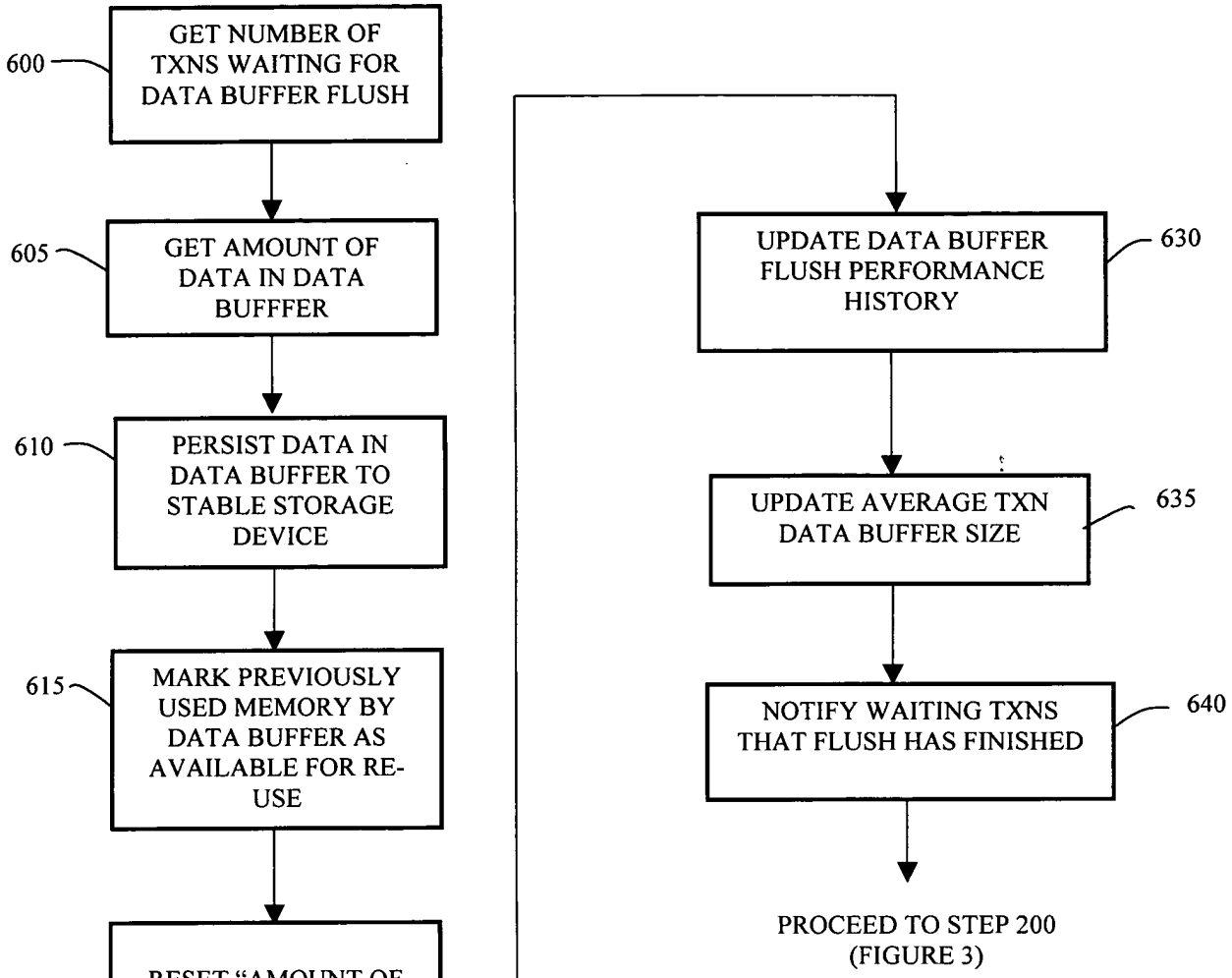

600
GET NUMBER OF TXNS WAITING FOR DATA BUFFER FLUSH
605
GET AMOUNT OF DATA IN DATA BUFFFER
610
PERSIST DATA IN DATA BUFFER TO STABLE STORAGE DEVICE
615
MARK PREVIOUSLY USED MEMORY BY DATA BUFFER AS AVAILABLE FOR RE-USE
620
RESET "AMOUNT OF DATA IN DATA BUFFER" PARAMETER TO ZERO
625
RECORD DURATION OF OPERATIONS OF STEPS 610, 611 AND 612
630
UPDATE DATA BUFFER FLUSH PERFORMANCE HISTORY
635
UPDATE AVERAGE TXN DATA BUFFER SIZE
640
NOTIFY WAITING TXNS THAT FLUSH HAS FINISHED
PROCEED TO STEP 200 (FIGURE 3)

FIGURE 7

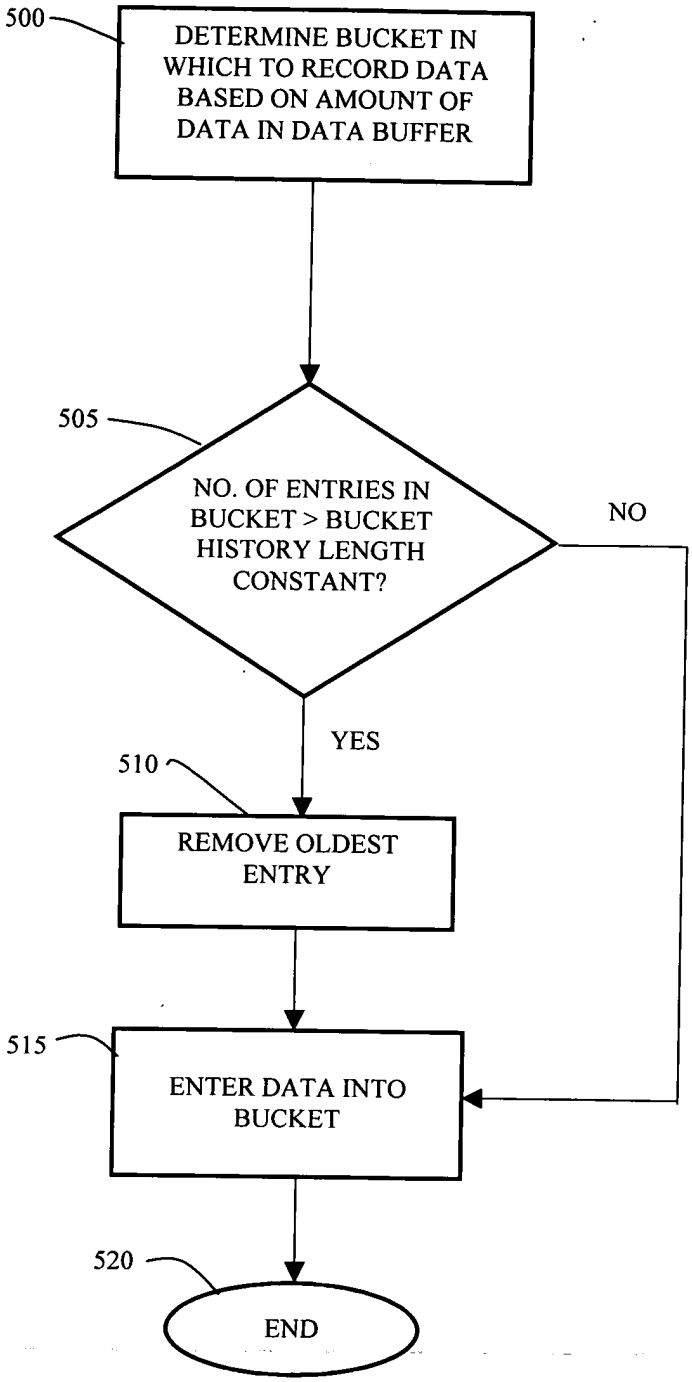

500
DETERMINE BUCKET IN WHICH TO RECORD DATA BASED ON AMOUNT OF DATA IN DATA BUFFER
505
NO. OF ENTRIES IN BUCKET > BUCKET HISTORY LENGTH CONSTANT?
NO
YES
510
REMOVE OLDEST ENTRY
515
ENTER DATA INTO BUCKET
520
END

FIGURE 8

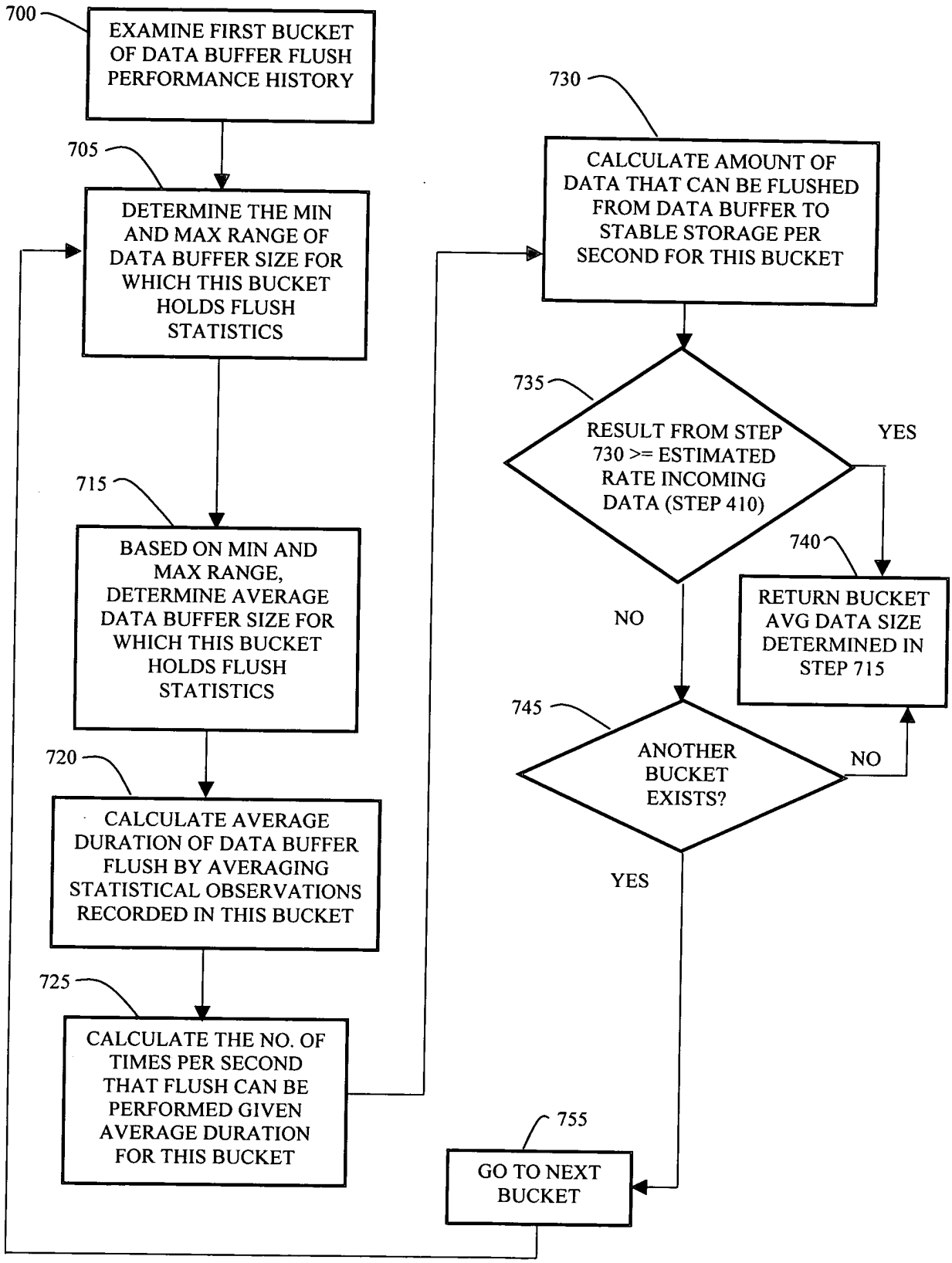

700
EXAMINE FIRST BUCKET OF DATA BUFFER FLUSH PERFORMANCE HISTORY
705
DETERMINE THE MIN AND MAX RANGE OF DATA BUFFER SIZE FOR WHICH THIS BUCKET HOLDS FLUSH STATISTICS
715
BASED ON MIN AND MAX RANGE, DETERMINE AVERAGE DATA BUFFER SIZE FOR WHICH THIS BUCKET HOLDS FLUSH STATISTICS
720
CALCULATE AVERAGE DURATION OF DATA BUFFER FLUSH BY AVERAGING STATISTICAL OBSERVATIONS RECORDED IN THIS BUCKET
725
CALCULATE THE NO. OF TIMES PER SECOND THAT FLUSH CAN BE PERFORMED GIVEN AVERAGE DURATION FOR THIS BUCKET
730
CALCULATE AMOUNT OF DATA THAT CAN BE FLUSHED FROM DATA BUFFER TO STABLE STORAGE PER SECOND FOR THIS BUCKET
735
RESULT FROM STEP 730 >= ESTIMATED RATE INCOMING DATA (STEP 410)
YES
NO
740
RETURN BUCKET AVG DATA SIZE DETERMINED IN STEP 715
745
ANOTHER BUCKET EXISTS?
NO
YES
755
GO TO NEXT BUCKET

FIGURE 9